

(12) INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(19) World Intellectual Property  
Organization  
International Bureau



(43) International Publication Date  
4 March 2004 (04.03.2004)

PCT

(10) International Publication Number  
**WO 2004/018824 A3**

(51) International Patent Classification<sup>7</sup>: **E21B 23/00,**  
F16L 25/00

(21) International Application Number:  
PCT/US2003/025677

(22) International Filing Date: 18 August 2003 (18.08.2003)

(25) Filing Language: English

(26) Publication Language: English

(30) Priority Data:  
60/405,610 23 August 2002 (23.08.2002) US

(71) Applicant (for all designated States except US): **ENVEN-  
TURE GLOBAL TECHNOLOGY** [US/US]; 16200 A  
Park Row, Houston, TX 77084 (US).

(72) Inventors; and

(75) Inventors/Applicants (for US only): **SHUSTER, Mark**  
[US/US]; 19115 Prospect Ridge Lane, Houston, TX 77094  
(US). **RING, Lev** [RU/US]; 14126 Heatherhill Place,  
Houston, TX 77077 (US).

(74) Agents: **MATTINGLY, Todd et al.**; Haynes and Boone,  
LLP, 901 Main Street, Suite 3100, Dallas, TX 75202 (US).

(81) Designated States (*national*): AE, AG, AI, AM, AT, AU,  
AZ, BA, BB, BG, BR, BY, BZ, CA, CH, CN, CO, CR, CU,  
CZ, DE, DK, DM, DZ, EC, EE, ES, FI, GB, GD, GE, GH,  
GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC,  
LK, LR, LS, LT, LU, LV, MA, MD, MG, MK, MN, MW,  
MX, MZ, NO, NZ, OM, PH, PL, PT, RO, RU, SC, SD, SE,  
SG, SK, SI, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ,  
VC, VN, YU, ZA, ZM, ZW.

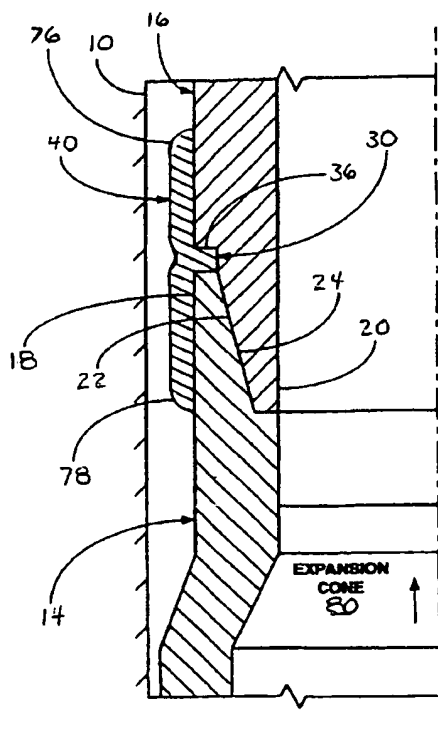
(84) Designated States (*regional*): ARIPO patent (GH, GM,  
KE, LS, MW, MZ, SD, SL, SZ, TZ, UG, ZM, ZW),  
Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM),  
European patent (AT, BE, BG, CH, CY, CZ, DE, DK, EE,  
ES, FI, FR, GB, GR, HU, IE, IT, LU, MC, NL, PT, RO,  
SE, SI, SK, TR), OAPI patent (BF, BJ, CF, CG, CI, CM,  
GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG).

Declaration under Rule 4.17:

— of inventorship (Rule 4.17(iv)) for US only

[Continued on next page]

(54) Title: **MAGNETIC IMPULSE APPLIED SLEEVE METHOD OF FORMING A WELLBORE CASING**



(57) Abstract: A method of forming a wellbore casing within a bore-  
hole (10) that traverses a subterranean formation includes the steps of  
assembling a tubular liner by coupling a threaded portion (24) of a  
first tubular member (16) to a threaded portion (22) of a second tubu-  
lar member (14) and coupling a tubular sleeve (40) to the threaded  
portions (22,24) of the first (16) and second (14) tubular members.  
The method further includes positioning the wellbore casing within  
the borehole (10). The step of coupling the tubular sleeve (40) through  
the threaded portions (22,24) of the first (16) and second (14) tubular  
members includes applying impulsive magnetic energy to the tubular  
sleeve (40).

WO 2004/018824 A3

BEST AVAILABLE COPY



**Published:**

- with international search report
- before the expiration of the time limit for amending the claims and to be republished in the event of receipt of amendments

*For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.*

**(88) Date of publication of the international search report:**

29 July 2004

## INTERNATIONAL SEARCH REPORT

International application No.

PCT/US03/25677

## A. CLASSIFICATION OF SUBJECT MATTER

IPC(7) : E21B 23/00; F16L 25/00

US CL : 166/207,380; 285/333

According to International Patent Classification (IPC) or to both national classification and IPC

## B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

U.S. : 166/207,380,206,313,381,242.6; 285/333,53; 403/179,273

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)  
Please See Continuation Sheet

## C. DOCUMENTS CONSIDERED TO BE RELEVANT

| Category * | Citation of document, with indication, where appropriate, of the relevant passages | Relevant to claim No. |
|------------|--|-----------------------|
| A, P       | US 2003/0067166 A1 (SIVLEY, IV) 10 April 2003 (10.04.2003), whole document.        | 1-4                   |
| A          | US 5,314,014 A (TUCKER) 24 May 1994 (24.05.1994), whole document.                  | 1-4                   |
| A          | US 4,614,233 A (MENARD) 30 September 1986 (30.09.1986), whole document.            | 1-4                   |
| A          | US 3,520,049 A (LYSENKO et al) 14 July 1970 (14.07.1970), whole document.          | 1-4                   |

☐ Further documents are listed in the continuation of Box C.☐ See patent family annex.

## \* Special categories of cited documents:

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier application or patent published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T"

later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X"

document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y"

document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

"&amp;"

document member of the same patent family

Date of the actual completion of the international search

12 December 2003 (12.12.2003)

Date of mailing of the international search report

21 MAY 2004

Name and mailing address of the ISA/US

Mail Stop PCT, Attn: ISA/US  
Commissioner for Patents  
P.O. Box 1450  
Alexandria, Virginia 22313-1450  
Facsimile No. (703) 305-3230

Authorized officer

David J. Baggett

Telephone No. (703) 308-1113

**INTERNATIONAL SEARCH REPORT**

PCT/US03/25677

**Continuation of B. FIELDS SEARCHED Item 3:**  
JPO, EPO, Derwent

Terms: sleeve, tubular, expansion/expand, magnetic, impulse/impulsive

**(19) World Intellectual Property  
Organization  
International Bureau**



(10) International Publication Number  
**WO 2004/018824 A3**

**PCT**

- (51) **International Patent Classification<sup>7</sup>:** E21B 23/00, F16L 25/00

(21) **International Application Number:** PCT/US2003/025677

(22) **International Filing Date:** 18 August 2003 (18.08.2003)

(25) **Filing Language:** English

(26) **Publication Language:** English

(30) **Priority Data:** 60/405,610 23 August 2002 (23.08.2002) US

(71) **Applicant (for all designated States except US):** ENVENTURE GLOBAL TECHNOLOGY [US/US]; 16200 A Park Row, Houston, TX 77084 (US).

(72) **Inventors; and**

(75) **Inventors/Applicants (for US only):** SHUSTER, Mark [US/US]; 19115 Prospect Ridge Lane, Houston, TX 77094 (US). RING, Lev [RU/US]; 14126 Heatherhill Place, Houston, TX 77077 (US).

(74) **Agents:** MATTINGLY, Todd et al.; Haynes and Boone, LLP, 901 Main Street, Suite 3100, Dallas, TX 75202 (US).

(81) **Designated States (national):** AE, AG, AL, AM, AT, AU, AZ, BA, BB, BG, BR, BY, BZ, CA, CH, CN, CO, CR, CU, CZ, DE, DK, DM, DZ, EC, EE, ES, FI, GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MA, MD, MG, MK, MN, MW, MX, MZ, NO, NZ, OM, PH, PL, PT, RO, RU, SC, SD, SE, SG, SK, SL, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, YU, ZA, ZM, ZW.

(84) **Designated States (regional):** ARIPO patent (GI, GM, KE, LS, MW, MZ, SD, SL, SZ, TZ, UG, ZM, ZW), Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European patent (AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HU, IE, IT, LU, MC, NL, PT, RO, SE, SI, SK, TR), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG).

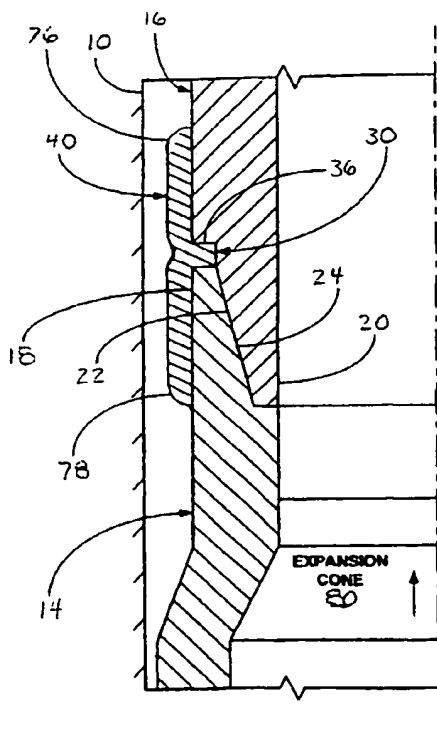
**Declaration under Rule 4.17:**  
— of inventorship (Rule 4.17(iv)) for US only

**Declaration under Rule 4.17:**

— *of inventorship (Rule 4.17(iv)) for US only*

*[Continued on next page]*

(54) Title: MAGNETIC IMPULSE APPLIED SLEEVE METHOD OF FORMING A WELLBORE CASING



**(57) Abstract:** A method of forming a wellbore casing within a borehole (10) that traverses a subterranean formation includes the steps of assembling a tubular liner by coupling a threaded portion (24) of a first tubular member (16) to a threaded portion (22) of a second tubular member (14) and coupling a tubular sleeve (40) to the threaded portions (22,24) of the first (16) and second (14) tubular members. The method further includes positioning the wellbore casing within the borehole (10). The step of coupling the tubular sleeve (40) through the threaded portions (22,24) of the first (16) and second (14) tubular members includes applying impulsive magnetic energy to the tubular sleeve (40).

**WO 2004/018824 A3**



**Published:**

- with international search report
- with amended claims

**Date of publication of the amended claims:** 7 April 2005

**(88) Date of publication of the international search report:**  
29 July 2004

*For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.*

**AMENDED CLAIMS**

[received by the International Bureau on 20 July 2004 (20.07.04);  
original claims 1-4 have been amended; claims 5-16 have been added]

**Claims**

What is claimed is:

1. A method of forming a wellbore casing within a borehole that traverses a subterranean formation, comprising:
  - assembling a tubular liner assembly by a process comprising:
    - coupling a threaded portion of a first tubular member to the threaded portion of a second tubular member; and
    - coupling a tubular sleeve to the threaded portions of the first and second tubular members;
  - positioning the tubular liner assembly within the borehole; and
  - radially expanding and plastically deforming the tubular liner assembly within the borehole;
  - wherein coupling the tubular sleeve to the threaded portions of the first and second tubular members comprises:
    - applying impulsive magnetic energy to the tubular sleeve.
2. A method of forming a coupling between metallic tubular members comprising a process comprising:
  - forming a female coupling portion on a first tubular member;
  - forming a male coupling portion on a second tubular member;
  - forming at least one raised ridge ring between the male and female coupling portions;
  - coupling the female coupling portion of the first tubular member and the male portion of the second tubular member including pressing the coupling portions together in surface-to-surface contact;
  - applying a tubular sleeve to exterior surfaces of the pressed together coupling portions of the first and second tubular members using a magnetic impulse generator; and
  - radially expanding and plastically deforming the coupling between the tubular members with the tubular sleeve applied.
3. The method of claim 2, wherein coupling the male and female coupling portions together further comprises forming at least one ridge ring interposed between the coupling portions to increase the surface-to-surface stress, thereby facilitating sealing between the first and second tubular members.

4. The method of claim 2 wherein coupling the male and female coupling portions together further comprises forming a layer of material softer than the metallic tubular members interposed between the coupling portions to increase the surface-to-surface stress, thereby facilitating sealing between the first and second tubular members.
5. A method of forming a wellbore casing within a borehole that traverses a subterranean formation, comprising:
  - assembling a tubular liner assembly by a process comprising:
    - coupling an end of a first tubular member to an end of a second tubular member; and
    - coupling a tubular sleeve to the ends of the first and second tubular members;
  - positioning the tubular liner assembly within the borehole; and
  - radially expanding and plastically deforming the tubular liner assembly within the borehole;wherein coupling the tubular sleeve to the ends of the first and second tubular members comprises:
  - applying impulsive magnetic energy to the tubular sleeve.
6. A method of forming a coupling between metallic tubular members comprising a process comprising the steps of:
  - coupling the ends of first and second tubular members;
  - applying a tubular sleeve to the ends of the first and second tubular members using magnetic energy; and
  - radially expanding and plastically deforming the coupling between the first and second tubular members with the tubular sleeve applied.
7. The method of claim 6, wherein coupling the ends of the first and second tubular members comprises increasing the surface-to-surface stress between the first and second tubular members.
8. The method of claim 6, wherein coupling the ends of the first and second tubular members comprises forming a layer of material softer than the ends of the first and second tubular members interposed between the ends of the first and second tubular members.
9. A system for forming a wellbore casing within a borehole that traverses a subterranean formation, comprising:
  - means for assembling a tubular liner assembly comprising:



means for coupling a threaded portion of a first tubular member to the threaded portion of a second tubular member; and

means for coupling a tubular sleeve to the threaded portions of the first and second tubular members;

means for positioning the tubular liner assembly within the borehole; and

means for radially expanding and plastically deforming the tubular liner assembly within the borehole;

wherein means for coupling the tubular sleeve to the threaded portions of the first and second tubular members comprises:

means for applying impulsive magnetic energy to the tubular sleeve.

10. A system for forming a coupling between metallic tubular members comprising:

means for forming a female coupling portion on a first tubular member;

means for forming a male coupling portion on a second tubular member;

means for forming at least one raised ridge ring between the male and female coupling portions;

means for coupling the female coupling portion of the first tubular member and the male portion of the second tubular member including pressing the coupling portions together in surface-to-surface contact;

means for applying a tubular sleeve to exterior surfaces of the pressed together coupling portions of the first and second tubular members using magnetic energy; and

means for radially expanding and plastically deforming the coupling between the tubular members with the tubular sleeve applied.

11. The system claim 10, wherein means for coupling the male and female coupling portions together further comprises means for forming at least one ridge ring interposed between the coupling portions to increase the surface-to-surface stress.

12. The system of claim 10, wherein means for coupling the male and female coupling portions together further comprises means for forming a layer of material softer than the metallic tubular members interposed between the coupling portions to increase the surface-to-surface stress, thereby facilitating sealing between the first and second tubular members.

13. A system for forming a wellbore casing within a borehole that traverses a subterranean formation, comprising:

means for assembling a tubular liner assembly by a process comprising:

means for coupling an end of a first tubular member to an end of a second tubular member; and

means for coupling a tubular sleeve to the ends of the first and second tubular members;

means for positioning the tubular liner assembly within the borehole; and

means for radially expanding and plastically deforming the tubular liner assembly within the borehole;

wherein means for coupling the tubular sleeve to the ends of the first and second tubular members comprises:

applying impulsive magnetic energy to the tubular sleeve.

14. A system for forming a coupling between metallic tubular members comprising:  
means for coupling the ends of first and second tubular members;  
means for applying a tubular sleeve to the ends of the first and second tubular members using magnetic energy; and  
means for radially expanding and plastically deforming the coupling between the first and second tubular members with the tubular sleeve applied.
15. The system of claim 14, wherein means for coupling the ends of the first and second tubular members comprises means for increasing the surface-to-surface stress between the first and second tubular members.
16. The system of claim 14, wherein means for coupling the ends of the first and second tubular members comprises means for forming a layer of material softer than the ends of the first and second tubular members interposed between the ends of the first and second tubular members.

**This Page is Inserted by IFW Indexing and Scanning  
Operations and is not part of the Official Record**

**BEST AVAILABLE IMAGES**

Defective images within this document are accurate representations of the original documents submitted by the applicant.

Defects in the images include but are not limited to the items checked:

☐ **BLACK BORDERS**

☐ **IMAGE CUT OFF AT TOP, BOTTOM OR SIDES**

☐ **FADED TEXT OR DRAWING**

☒ **BLURRED OR ILLEGIBLE TEXT OR DRAWING**

☐ **SKEWED/SLANTED IMAGES**

☒ **COLOR OR BLACK AND WHITE PHOTOGRAPHS**

☐ **GRAY SCALE DOCUMENTS**

☒ **LINES OR MARKS ON ORIGINAL DOCUMENT**

☐ **REFERENCE(S) OR EXHIBIT(S) SUBMITTED ARE POOR QUALITY**

☐ **OTHER:** \_\_\_\_\_

**IMAGES ARE BEST AVAILABLE COPY.**

**As rescanning these documents will not correct the image problems checked, please do not report these problems to the IFW Image Problem Mailbox.**